CONTINUOUS SPINAL ANESTHESIA FOR LABOR AND DELIVERY*

A PRELIMINARY REPORT

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IN 1942 HINGSON AND EDWARDS[1] through a familiarity with the continuous spinal anesthesia method introduced by Lemmon,[2] first published their report on continuous caudal analgesia in obstetrics. The effect of this work was to stimulate anew, widespread interest in painless childbirth. Both the advantages and the inherent dangers of the method have been subjected to critical analysis by many investigators. It is generally agreed that the most important cause of failure is the inability to insert the needle properly into the caudal canal. We decided, therefore, to investigate the possibility of continuous spinal anesthesia. While the method has been used for some time in cesarean section, this is the first attempt, to our knowledge, to apply it to labor and vaginal delivery. This preliminary report is based on our experience in its use on fifty cases.

METHOD

The technic employed has not been entirely uniform. In the first five cases we followed the principle as originally advocated by Lemmon[2] using a standard continuous spinal set with a 19 gauge malleable nickel needle. In our desire to keep the anesthesia as low as possible the third or fourth lumbar interspace was chosen as the site of injection. The anesthetic agent was procaine hydrochloride 5 per cent in normal saline. The standard dose was 15 mg. With this technic relief of pain usually occurred within five minutes. However, in most instances the patient experienced dull pain in the back with each uterine contraction. This unfavorable reaction prompted us to inject at a higher level. When this was done the relief of pain was complete within three minutes. While the choice of the first or second interspace may seem to many unnecessarily high, this location is physiologically correct. The truth of this statement can be verified by examination of the chart in Figure 1 showing the sensory pathways to the uterus. The average interval between injections using a 5 per cent procaine hydro-

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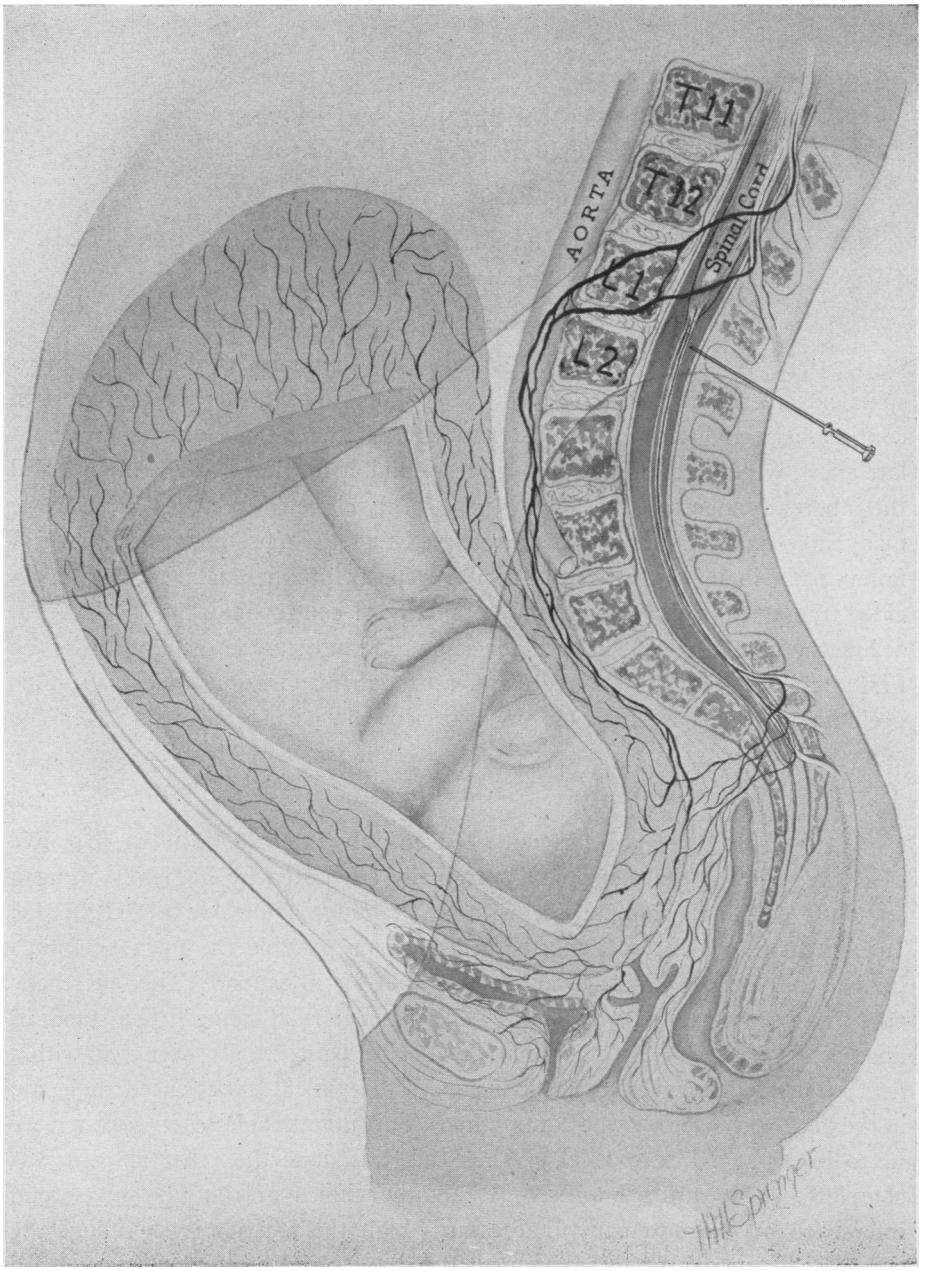

FIG. 1.—Sagittal section of a pregnant woman showing spinal needle in place between the first and second lumbar vertebrae. Note the needle's proximity to (1) the eleventh and twelfth thoracic nerves which carry uterine sensory fibers, and (2) the second, third, and fourth sacral nerves which carry sensory fibers from the cervix and lower birth canal.

Puncture of the dura at a higher level might result in injury to the spinal cord. Motor fibers, not shown, are involved if the anesthesia blocks the sixth or higher thoracic nerves.

chloride was 30 to 40 minutes. Two per cent procaine hydrochloride was then tried. This was found to be unsatisfactory for two reasons; namely, a higher dosage requirement (20 mg.) and a shorter interval between doses (15 to 20 minutes). Despite the fact that our results in these early cases were encouraging, we were not satisfied with this method primarily because of the length of the needle and the difficulty in keeping it in the subarachnoid space with the inevitable motion of the patient while in labor.

Our present technic is as follows: the patient is placed on either side with the back flexed, which is the most favorable position for lumbar puncture. After a thorough surgical preparation a 2.5- or 3-inch malleable steel needle of the type used by Hingson and Edwards in caudal anesthesia is inserted into the first or second lumbar interspace. A free drip of spinal fluid is obtained. The back is then extended in order to fix the needle firmly. The needle is then connected by rubber tubing to a 20 cc. Luer-Lok syringe with cut off valve containing 1.5 per cent Metycaine in Ringer's solution. The standard dose is 15 mg. (1 cc.) which is repeated at necessary intervals to secure complete relief of pain (25 to 40 minutes). The height of the anesthesia level is tested at frequent intervals. We have found the sensory loss should extend 2 to 3 cm. above the umbilicus. Should the level rise above this point, there is danger of causing a cessation of uterine contractions. It is important that while we have found this dosage sufficient to produce anesthesia, complete motor paralysis does not occur. In practically all cases the needle was withdrawn when the patient was placed on the delivery table, due to the fact that a split-mattress was not available. In our opinion this is undesirable because it destroys an important safety factor, namely the ability to withdraw the anesthetic agent in the event of any untoward effect of the anesthetic solution.

In several patients spinal fluid was withdrawn following the delivery in order to determine the Metycaine content. Report of one specimen from the laboratory of Eli Lilly and Company is as follows:

> "J. S., age 31, para 1—continuous spinal July 6/44, 8 cc. Spinal fluid withdrawn following delivery. The specimen as measured in our laboratory contained 7.5 cc. The concentration was 4.9 mg. "metycaine" (*gamma* [2-methylpiperidino]-propyl benzoate hydrochloride, Lilly) per cc. or a total quantity of about 37 mg. This patient received 60 mg. of metycaine over a period of two hours."

The presence of this concentration of the anesthetic in the spinal fluid serves to emphasize the desirability of keeping the needle in place until completion of the delivery.

RESULTS

Complete relief of pain was obtained in 40 cases, or 80 per cent, partial relief of pain was obtained in eight cases or 16 per cent. Two cases, or 4 per cent, were complete failures despite the fact that in each instance a free flow of spinal fluid was obtained and an adequate dose of anesthetic administered. In three cases, or 6 per cent, the anesthetic was discontinued because of

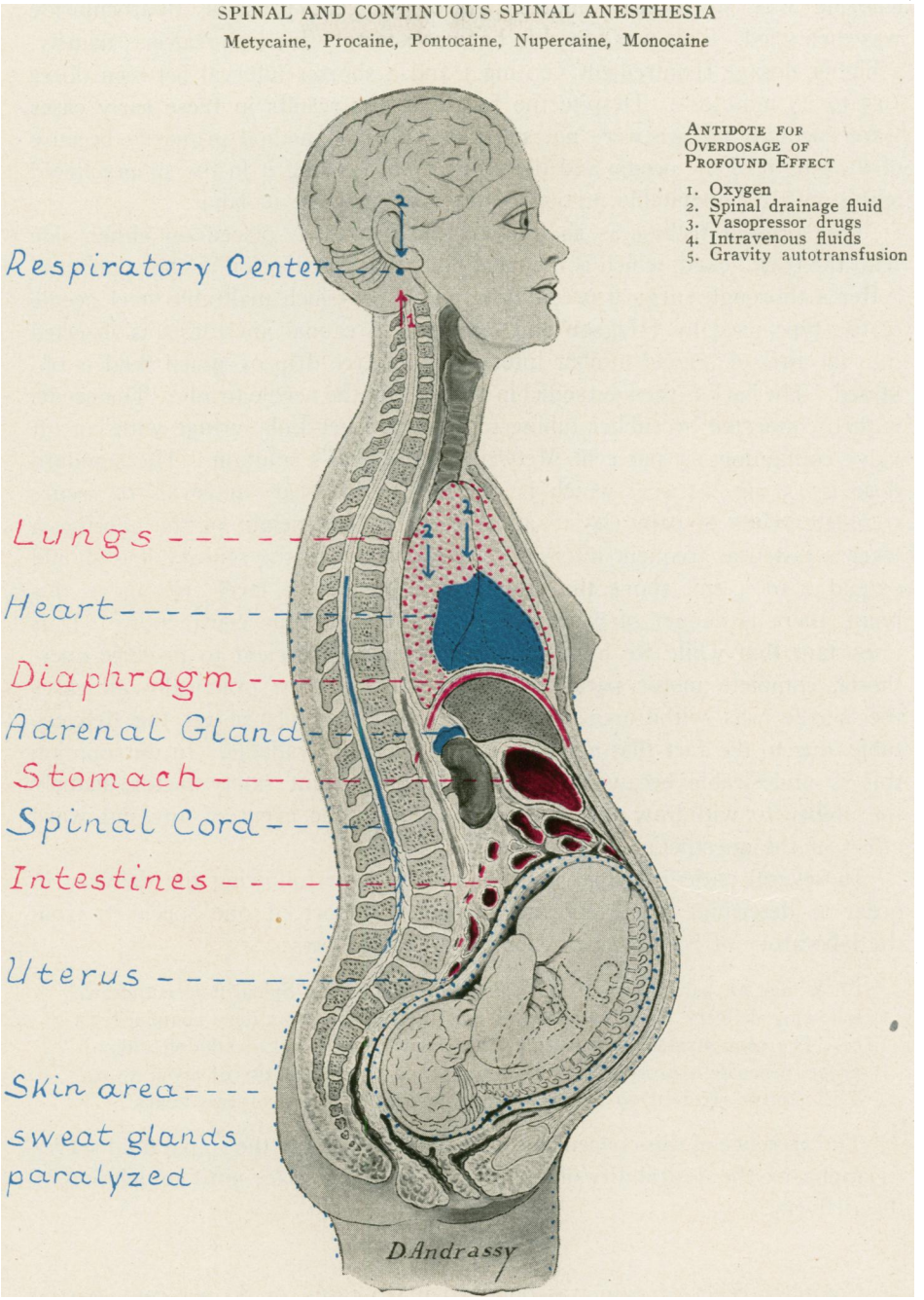

FIG. 2.—RED indicates stimulation and BLUE indicates depression of maternal and fetal organs. Solid color indicates intensified action, Dotted color indicates moderate action, and Outline dots indicate minimal action. Numbers (1 and 2) on ascending and descending arrows indicate sequence of stimulation and depression.

—From "Control of Pain in Childbirth," by Clifford A. Lull, M.D. and Robert A. Hingson, M.D., J. B. Lippincott Company, Philadelphia, Pa.

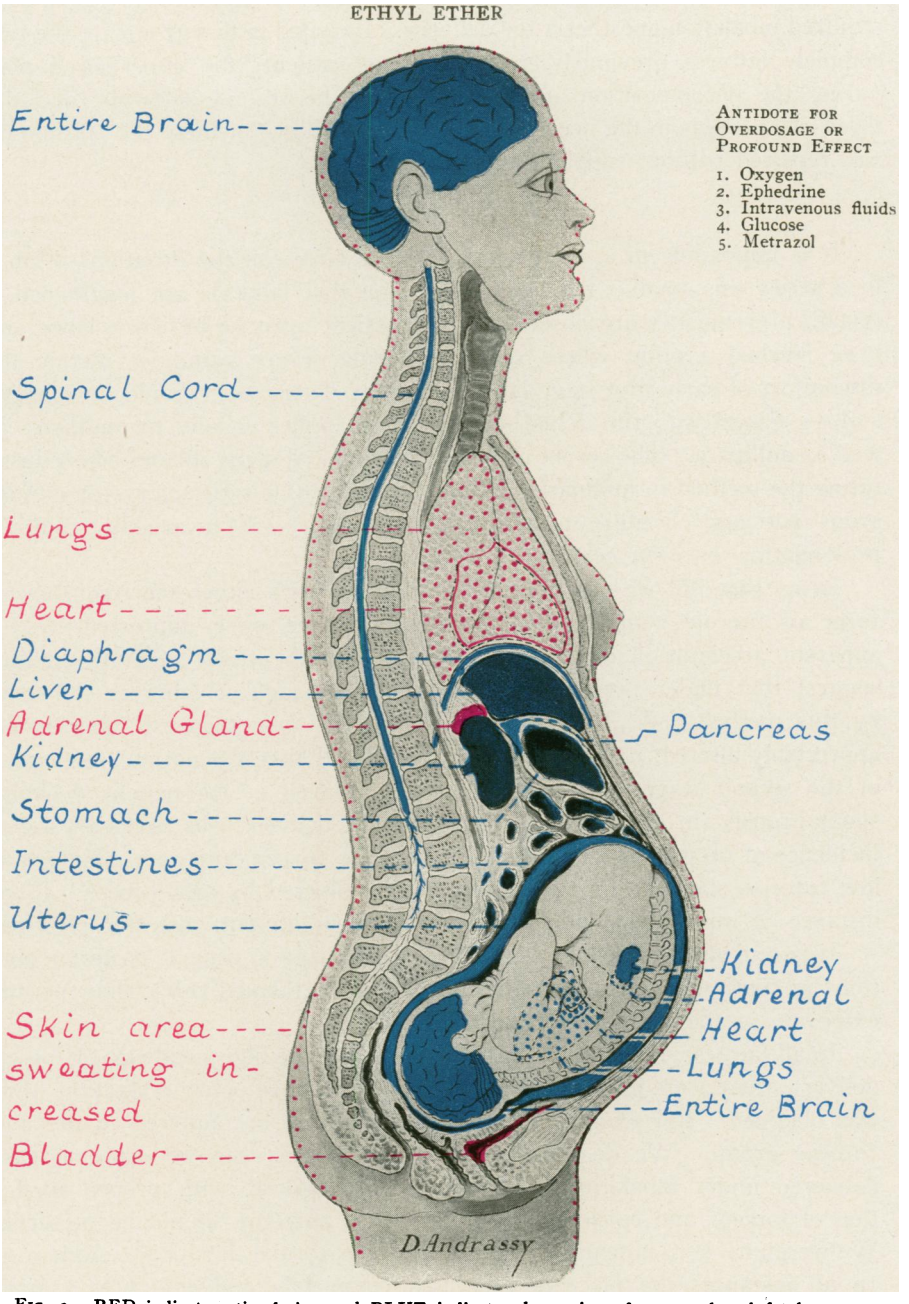

FIG. 3.—RED indicates stimulation and BLUE indicates depression of maternal and fetal organs. Solid color indicates intensified action, Dotted color indicates moderate action, and Outline dots indicate minimal action. Numbers (1 and 2) on ascending and descending arrows indicate sequence of stimulation and depression.

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dislodgment of the needle from the subarachnoid space. Six cases or 12 per cent required inhalation anesthesia for delivery. Included in this group are the two complete failures previously mentioned, one patient who experienced pain during the decomposition and extraction of the second of twins, and the three cases in whom the needle was dislodged (in two of these the episiotomy was repaired without supplementary anesthesia).

EFFECT ON LABOR

It is impossible to analyze accurately the effect on the duration of labor in a series this small. It is our impression that labor is not lengthened if certain prerequisites are observed. The patient must be in active labor and have reached a point where she is suffering severe pain, not merely the discomfort of early first-stage labor. The presenting part should be engaged and on a level with the ischial spines. This applies equally to multipara as well as nullipara. The cervix should be effaced and 4 cm. dilated before instituting the method in nullipara. Dilatation of 2 cm. is satisfactory for multiparous patients. Failure to observe these rules will invariably result in prolongation or even cessation of labor.

In no case did we observe any interference with either the frequency or force of uterine contractions. Furthermore, we were impressed by the apparent acceleration of cervical dilatation. This would seem to at least suggest that under proper conditions the first stage of labor is shortened by this method. While the mechanism of the first stage of labor is not appreciably altered, it must be frankly admitted that the normal mechanism of the second stage is in most instances delayed. One patient delivered spontaneously, in the remaining 49 operative delivery was necessary or an incidence of 98 per cent. Forty-three cases or 86 per cent were delivered by low forceps, six cases or 12 per cent were delivered by mid-forceps. Every instance of mid-forceps application occurred in occiput posterior positions.

It is our impression that mid-forceps is the rule in occiput posterior positions in continuous spinal anesthesia because the relaxed pelvic floor permits extension of the head with resultant arrest.

In all fairness, it should be stated that despite the high incidence of forceps delivery, these were greatly facilitated by the complete pelvic relaxation which was obtained. For example, no sulcus tears were encountered in the mid-forceps group. We do not believe this statement can be made in cases delivered under inhalation anesthesia. Furthermore, with proper application of forceps and episiotomy, normal pelvic anatomy should be preserved. We were unable to note any deviation from the normal third-stage mechanism. In all instances the placenta separated completely and promptly (usually within three minutes) and was expressed by the simple procedure of traction and fundal pressure. No case of retained placenta occurred.

While the blood loss was not measured, we believe that we may state with accuracy that it was less than normal, *i.e.*, less than 250 cc. In no case did the uterus fail to contract firmly at the end of the third stage, thus

precluding the necessity for the routine use of oxytoxics. We do not advise the administration of either pituitrin or any ergot derivative until termination of the third stage. Failure to observe this precaution may result in retained placenta.

EFFECT ON THE MOTHER

Ninety per cent of the mothers reacted favorably to this method and were enthusiastic over the dramatic relief of pain. Approximately 10 per cent, mainly multipara, were either emotionally or intellectually unsuitable for continuous spinal anesthesia. While their behavior was entirely satisfactory during labor, it was difficult to convince them upon arrival in the delivery room that they would experience no pain during the actual birth of the child. There were no instances of broken needles. Infections, severe circulatory collapse or sensitivity to the various drugs were not encountered. In a few cases primary unilateral anesthesia occurred. This was easily overcome by additional dosage and placing the patient on the opposite side. Little or no alteration of blood pressure occurred in the vast majority of cases. In only three patients did the blood pressure drop to a serious level. Rapid restoration was effected by the administration of oxygen, a vasoconstrictor drug and elevation of the lower extremities to a 90 degree angle. Twelve per cent of the group were hypertensive because of toxemia. In each instance the blood pressure was lowered and the urinary output increased under continuous spinal anesthesia.

One patient developed postpartum eclampsia. She was admitted to the hospital in labor complicated by severe toxemia, her blood pressure being 180/120. During ten hours of spinal anesthesia the blood pressure dropped to 140/100 and the urinary output was 1200 cc. (Spinal was instituted early to observe its effect in severe toxemia). It is our belief that the single convulsion which followed did not result from the anesthesia.

Twenty-two cases, or 42 per cent, experienced rather severe but transient headache which was relieved by mild analgesics. This complication could be prevented in most instances by having the patient remain in the supine position without a pillow for 48 hours postpartum. There were no instances of backache or pain in the legs during the postpartum period. Twelve cases or 24 per cent had urinary retention following delivery. All of these were transient, disappearing by the end of 72 hours. This incidence is no higher in our experience than with other anesthetics. Maternal morbidity in our series was 6 per cent. There were no maternal deaths.

EFFECT ON THE INFANT

Spinal and continuous spinal anesthesia have no adverse effect upon the foetus. The illustrative charts reproduced here show the comparative effect on both mother and child of spinal anesthesia and ethyl ether. The marked contrast between the two graphically demonstrates the superiority of spinal anesthesia. Dr. Kenneth A. Heard of the University of Toronto has stated: "He who denies the baby the safety of spinal anesthesia, must be prepared

to accept the responsibility for its protection from ether." There were 51 live babies in this series and no stillbirths. Respiration was spontaneous and immediate and all infants cried lustily. Cyanosis did not occur in a single case. One infant died 72 hours postpartum. This occurred in a seven months premature and in our opinion can not be attributed to the anesthesia.

INDICATIONS AND CONTRAINDICATIONS

Although our series is small and our experience with this method limited, we feel that continuous fractional spinal anesthesia is especially indicated in the following conditions: (1) prematurity; (2) some cases of heart disease; (3) hypertensive toxemia; (4) pulmonary disease, such as tuberculosis; (5) previous cervical and vaginal repair because of its relaxing effect on the lower uterine segment, pelvic floor and perineum.

Contraindications may be divided into local, general and obstetric. The local contraindications are: (1) deformity of the spine or disease of the spinal cord; (2) local infections at or near the site of injection. The general contraindications are: (1) marked obesity; (2) history of sensitivity to the drug; (3) those emotionally unsuited; (4) severe anemia.

The obstetrical contraindications are: (1) nonengagement of the presenting part; (2) cephalopelvic disproportion; (3) known fetal deformity or dead baby; (4) placenta previa; (5) internal podalic version.

COMMENT

Continuous spinal anesthesia for labor and vaginal delivery is still in the experimental stage. We urge extreme caution in its use. It should only be employed either in the hands or under the direction of one completely familiar with the technic and in a well equipped institution. All precautions to safeguard the patient's welfare should be taken. Oxygen, vasoconstrictor drugs, stimulants and intravenous fluids should be immediately available at all times. Because of the high incidence of operative delivery, continuous spinal anesthesia should not be attempted by the untrained obstetrician. The method is time-consuming and requires constant personal supervision. It is both unfair and dangerous to give the initial injection and then place the responsibility for its continuation in the hands of an intern or nurse. We feel that continuous spinal anesthesia affords the patient the additional safety factor of withdrawal of the anesthetic agent should any untoward effect occur. This is in contrast to caudal or single injection spinal in which this is impossible.

SUMMARY

1. Fifty cases of continuous fractional spinal anesthesia for labor and delivery are presented and discussed.

2. Comparison between the various drugs seems to indicate the superiority of 1.5 per cent metycaine in Ringer's solution.

3. It has been shown that the most favorable site of injection is the first or second lumbar interspace.

4. Premature institution of the method invariably results in prolongation or cessation of labor.

5. The patient should be in active labor with the presenting part in mid pelvis and the cervix 2 to 4 cm. dilated, depending upon the parity.

6. The progress of the first stage is apparently accelerated.

7. The second stage of labor is altered, and the incidence of operative delivery is greatly incerased.

8. The third stage of labor proceeds normally, and the blood loss is minimal.

9. This anesthesia is without adverse effect on the baby.

10. We do not advocate this method as a routine procedure and urge caution in its employment. While no serious complications occurred in this series, further trial is necessary to evaluate its future place in obstetrical anesthesia.

REFERENCES

[1] Hingson, R. A., and Edwards, W. B.: Continuous Caudal Anesthesia in Obstetrics. Am. J. Surg., 57, 459, 1942.

[2] Lemmon, W. T.: A Method for Continuous Spinal Anesthesia. ANNALS OF SURGERY, 111, 141, 1940, *idem; ibid:* 120, 129, August, 1944.